

To: Kirk Ziegler[kziegler@anchorqea.com]
Cc: Vaughn, Stephanie[Vaughn.Stephanie@epa.gov]
From: Leonard, Edward L.
Sent: Mon 3/6/2017 5:20:59 PM
Subject: RE: Newtown Creek, Hydrodynamic and Sediment Transport Models...

EPA – Vaughn, Schmidt, Hayter (ACE) , Mathew (M&N), Roberts (CDM)

NYC – Miller (HDR) and Weissbard

Let me know if you need anything else.

ED

From: Kirk Ziegler [mailto:kziegler@anchorqea.com]
Sent: Monday, March 06, 2017 11:50 AM
To: Leonard, Edward L. <leonardel@cdmsmith.com>
Subject: RE: Newtown Creek, Hydrodynamic and Sediment Transport Models...

Sounds good

From: Leonard, Edward L. [mailto:leonardel@cdmsmith.com]
Sent: Monday, March 06, 2017 11:38 AM
To: Kirk Ziegler <kziegler@anchorqea.com>
Subject: RE: Newtown Creek, Hydrodynamic and Sediment Transport Models...

Just saw your VM. I will call back after lunch

From: Kirk Ziegler [mailto:kziegler@anchorqea.com]
Sent: Monday, March 06, 2017 8:54 AM

To: Leonard, Edward L. <leonardel@cdmsmith.com>; Vaughn, Stephanie <Vaughn.Stephanie@epa.gov>; Kevin Russell <krussell@anchoragea.com>
Cc: Miller, Robin (Robin.Miller@hdrinc.com) <Robin.Miller@hdrinc.com>; Roberts, Keegan <robertsk@cdmsmith.com>; Mathew, Rooni <RMathew@moffattnichol.com>; Kwan, Caroline <kwan.caroline@epa.gov>; Schmidt, Mark <schmidt.mark@epa.gov>; Hayter, Earl J ERDC-CHL-MS <Earl.Hayter@usace.army.mil>
Subject: RE: Newtown Creek, Hydrodynamic and Sediment Transport Models...

Hi Ed

Tomorrow from 3-4 PM would work for me.

Thanks

Kirk

From: Leonard, Edward L. [<mailto:leonardel@cdmsmith.com>]
Sent: Monday, March 06, 2017 8:52 AM
To: Kirk Ziegler <kziegler@anchoragea.com>; Vaughn, Stephanie <Vaughn.Stephanie@epa.gov>; Kevin Russell <krussell@anchoragea.com>
Cc: Miller, Robin (Robin.Miller@hdrinc.com) <Robin.Miller@hdrinc.com>; Roberts, Keegan <robertsk@cdmsmith.com>; Mathew, Rooni <RMathew@moffattnichol.com>; Kwan, Caroline <kwan.caroline@epa.gov>; Schmidt, Mark <schmidt.mark@epa.gov>; Hayter, Earl J ERDC-CHL-MS <Earl.Hayter@usace.army.mil>
Subject: RE: Newtown Creek, Hydrodynamic and Sediment Transport Models...

Kirk

EPA requested I get back. Looks like tomorrow 11 to 12 or 3 to 4. Otherwise it would need to be later in the week.

Ed

From: Kirk Ziegler [<mailto:kziegler@anchorqea.com>]
Sent: Friday, March 03, 2017 7:57 AM
To: Vaughn, Stephanie <Vaughn.Stephanie@epa.gov>; Kevin Russell <krussell@anchorqea.com>
Cc: Miller, Robin (Robin.Miller@hdrinc.com) <Robin.Miller@hdrinc.com>; Roberts, Keegan <robertsk@cdmsmith.com>; Mathew, Rooni <RMathew@moffattnichol.com>; Kwan, Caroline <kwan.caroline@epa.gov>; Schmidt, Mark <schmidt.mark@epa.gov>; Leonard, Edward L. <leonardel@cdmsmith.com>; Hayter, Earl J ERDC-CHL-MS <Earl.Hayter@usace.army.mil>
Subject: RE: Newtown Creek, Hydrodynamic and Sediment Transport Models...

Hi Stephanie

We would like to have a conference call with your model reviewers to get some clarification on these comments related to the hydro and sedtran models. Please let us know of some dates/times when it would be convenient to chat (my schedule is fairly open next week).

Thanks

Kirk

From: Vaughn, Stephanie [<mailto:Vaughn.Stephanie@epa.gov>]
Sent: Friday, February 17, 2017 4:35 PM
To: Kirk Ziegler <kziegler@anchorqea.com>; Kevin Russell <krussell@anchorqea.com>
Cc: Miller, Robin (Robin.Miller@hdrinc.com) <Robin.Miller@hdrinc.com>; Roberts, Keegan <robertsk@cdmsmith.com>; Mathew, Rooni <RMathew@moffattnichol.com>; Kwan, Caroline <kwan.caroline@epa.gov>; Schmidt, Mark <schmidt.mark@epa.gov>; Leonard, Edward L. <leonardel@cdmsmith.com>; Hayter, Earl J ERDC-CHL-MS <Earl.Hayter@usace.army.mil>
Subject: Newtown Creek, Hydrodynamic and Sediment Transport Models...

EPA's ongoing review of the draft Newtown Creek FMRM model has identified a few potentially significant issues in the hydrodynamic and sediment transport models. As these issues are important to the EPA team, and in the interest of continuing in the collaborative spirit of the modeling working group meetings, we are bringing these items to your attention now as we continue on with our review.

- **Hydrodynamic model:** This issue relates to the specification of the tide boundary condition at the northern boundary of the Newtown Creek model.

The Newtown Creek model grid extends into the East River, towards the south to The Battery and just past Roosevelt Island towards the north. While the tide boundary condition at The Battery was specified on the basis of NOAA measurements at this location, the tide boundary condition at the northern boundary was developed, for the most part, as the result of a calibration exercise. The latter is an unusual approach for defining boundary conditions.

The typical approach for defining boundary conditions involves either (1) extending the model domain to a location with suitable data, or (2) using the results of a regional-scale model to provide boundary conditions for the local-scale model of the domain of interest (e.g., Newtown Creek). The latter approach was used for the modeling of the Lower Passaic River and Newark Bay Superfund sites, whereas the model developed by NYCDEP for the Long-Term Control Plan for Newtown Creek uses a hybrid approach, using data from Kings Point at the model boundary in Long Island Sound and the results of a regional-scale model at the model boundary in Harlem River.

Furthermore, one of the objectives of such modeling studies is to examine fate and transport processes within a given domain. From this perspective, it is important to be able to resolve changes/processes occurring within the domain and driven by environmental conditions within the domain independently of the boundary condition. Using the boundary condition as a calibration parameter invalidates the applicability of the model from this perspective. Therefore, the boundary condition has to be treated independently of the model calibration; the latter should focus only on processes and transformations within the model domain. The use of a calibrated boundary condition calls into question the model development process, and ultimately its defensibility.

Close examination of the model performance documented in the draft FMRM also shows features and processes within Newtown Creek that are not reproduced by the numerical model, primarily as a consequence of the northern boundary condition that is based on neither data nor the results of a mechanistic model. Namely, the distortion of the tidal wave, generation of overtides, and its impact on currents, all of which are driven by the tidal distortion occurring in Long Island Sound and the non-linear interactions of the tide propagating from The Battery and Long Island Sound into the East River and Newtown Creek, are not reproduced by the model. A sensitivity run using the results of a regional-scale model to specify the boundary condition for tide at the northern boundary shows improvement in model performance with regard to the aforementioned processes and metrics. This provides further evidence in support of using the results of a regional-scale model to specify the northern boundary condition. In addition to an improvement in model performance with respect to the tide and currents within Newtown Creek, such an approach also improves the defensibility of the model application. In addition, the NCG already has access to the regional model – the draft FMRM includes sensitivity runs, although only for salinity, using the results of a regional model to define salinity boundary conditions.

Another issue that can be addressed while refining the model boundary conditions is the time-zone used for the model. Currently, the model is run in local time, which is a combination of Eastern Standard Time (EST) in Fall and Winter, and Eastern Daylight Time (EDT) in Spring and Summer. This leads to instantaneous discontinuities in the boundary conditions during the transition from EST to EDT and vice versa. Analogous to the fixed horizontal and vertical datum used for spatial referencing in the model, the standard approach for such models is to use a fixed temporal reference such as EST, which prevents the instantaneous discontinuities noted in the boundary conditions.

EPA's specific recommendations regarding the hydrodynamic model development at this time include:

- o Using the results of the regional hydrodynamic model (which includes Lower Hudson River, New York Harbor, Long Island Sound, and New York Bight; was developed and calibrated as described in Blumberg et al. [1999]) to specify the tide boundary condition at the northern boundary
- o Using the results of the above referenced regional-scale model to specify the temperature and salinity boundary condition at The Battery and the northern boundary
- o Using a standard time-zone (e.g. EST) for the temporal coordinate system in the model

Reference: Blumberg et al. (Blumberg, A.F., L.A. Khan, and J.P. St. John), 1999. Three-dimensional hydrodynamic model of New York Harbor region. *Journal of Hydraulic Engineering* 125(8):799-816.

- **Sediment transport model:** There is a potential mass balance issue in the model. While reviewing the mass composition in individual layers in the sediment bed, EPA noted a few instances where the sum of the various sediment fractions deviates significantly from 1 (ranges from 0.86 to 1.43) over the course of the simulation. Furthermore, there are a couple of instances where individual sediment classes for given cell/layer report negative mass fraction, which implies negative sediment mass for that sediment class in a given cell and bed layer. For the results examined (at the end of the 14-year simulation from 1999-2012), these instances of mass balance errors seem to affect only about a handful of cells within Newtown Creek. However, the spatial and temporal extent of this issue is unknown. Furthermore, depending on the cause of this issue, it may also affect the model performance more globally and its comparison to data.

Mass balance is a fundamental requirement for such mechanistic models. A mass balance error

in the sediment transport model, in addition to raising questions about the sediment transport model calibration and results, also has implications for the contaminant fate and transport model. Therefore, this is potentially a fatal flaw. However, neither its impact on other model performance metrics, nor its spatial and temporal prevalence are clear to EPA at this point.

EPA's specific recommendations regarding the sediment transport model development at this time include:

- o Assessing the impact of this issue on model performance, and a proposal to resolve it. EPA requires an understanding of whether this has a significant impact on model comparison to various calibration metrics in order to fully evaluate model performance and results.

If the NCG requires any further clarification on these issues, our model reviewers can be available to participate in a conference call with your technical team.

Thanks,
Stephanie

Stephanie Vaughn

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